

DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

Adoption of Chapter 3-181  
Hawaii Administrative Rules

October 13, 2009

SUMMARY

1. Chapter 181 of Title 3, Hawaii Administrative Rules, entitled "State Energy Conservation Code", is adopted.

HAWAII ADMINISTRATIVE RULES

TITLE 3

DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

SUBTITLE 14

STATE BUILDING CODE COUNCIL

CHAPTER 181

STATE ENERGY CONSERVATION CODE

Subchapter 1 Rules of General Applicability

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**SUBCHAPTER 1**

**RULES OF GENERAL APPLICABILITY**

**§3-181-1 Purpose.** The purpose of this chapter is to adopt the state energy conservation code as required by section 107-25, Hawaii Revised Statutes (HRS). [Eff MAY 24 2010 ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-2 Scope.** This chapter sets forth minimum requirements for the design and construction of buildings for the effective use of energy and is intended to provide flexibility to allow the use of innovative approaches and techniques to achieve the effective use of energy. [Eff MAY 24 2010 ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-3 Definitions.** In this chapter, unless the context otherwise requires:

"ICC" means the International Code Council.

"IECC Section" means a section of a chapter of the *International Energy Conservation Code*.

"IECC" means the ICC, *International Energy Conservation Code*, 2006 edition, as copyrighted by the International Code Council. [Eff MAY 24 2010 ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-4 Adoption of the International Energy Conservation Code.** The "*International Energy Conservation Code, 2006 Edition*" as copyrighted and published in 2006 by International Code Council, Incorporated, 500 New Jersey Avenue, 6<sup>th</sup> Floor, Washington, DC 20001, is adopted by reference and made a part of this chapter. This incorporation by reference includes all parts of the *International Energy Conservation Code* subject to the amendments hereinafter set forth. The appendices of the ICC, IECC are not adopted except as provided in this chapter. [Eff MAY 24 2010 ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-5**

**§3-181-5 Permit authorization.** Each county may, by ordinance, require that a permit be obtained from the building official for any area regulated by this chapter. [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**SUBCHAPTER 2**

**AMENDMENTS TO THE 2006 ICC INTERNATIONAL ENERGY CONSERVATION CODE**

**§3-181-6 Title.** Section 101.1 is amended to read as follows:

**"101.1 Title.** This code shall be known as the International Energy Conservation Code of the State of Hawaii, and shall be cited as such. It is referred to herein as "this code"." [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-7 Low energy buildings.** Section 101.5.2 is amended to read as follows:

**"101.5.2 Low energy buildings.** The following buildings, or portions thereof, separated from the remainder of the building by building thermal envelope assemblies complying with this code shall be exempt from the building thermal envelope provisions of this code:

1. Conditioned spaces with a peak design rate of energy usage less than 3.4 Btu/h·ft<sup>2</sup> (10.7 W/m<sup>2</sup>) or 1.0 watt/ft<sup>2</sup> (10.7 W/m<sup>2</sup>) of floor area for space conditioning purposes.
2. Unconditioned spaces that are non-habitable spaces." [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-8 General.** Section 104.1 is amended to read as follows:

**"104.1 General.** When the requirements in this code apply to a building as specified in Section 101.4, plans, specifications or other construction documents submitted for a building, electrical or plumbing permit required by the jurisdiction shall comply with this code and shall be prepared, designed, approved and observed by a design professional. The responsible design professional shall

provide on the plans a signed statement certifying that the project is in compliance with this code.

**Exception:** Any building, electrical or plumbing work that is not required to be prepared, designed, approved or observed by a licensed professional architect or engineer pursuant to chapter 464 Hawaii Revised Statutes." [Eff **MAY 24 2010**] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-9 Inspections.** Section 105 is deleted in its entirety. [Eff **MAY 24 2010**] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-10 Certificate.** Section 401.3 is amended to read as follows:

**"401.3 Certificate.** When required by the code official, a permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; U-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of heating, cooling and service water heating equipment." [Eff **MAY 24 2010**] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

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§3-181-11 Insulation and fenestration requirements by component. Table 402.1.1 is amended to read as follows:

**"Table 402.1.1  
Insulation And Fenestration Requirements By Component"**<sup>a</sup>

Climate Zone	Fenestration U-Factor	Skylight <sup>b</sup> U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement <sup>c</sup> Wall R-Value	Slab <sup>d</sup> R-Value & Depth	Crawl Space Wall R-Value
1	1.20	0.75	0.40	See Section 402.1.1.1	13	3	NR	NR	NR	NR
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40 <sup>e</sup>	30	13	5	19	0	0	5 / 13
4 except Marine	0.40	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5 <sup>g</sup>	13	30 <sup>f</sup>	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5 <sup>g</sup>	15	30 <sup>f</sup>	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19	30 <sup>f</sup>	10 / 13	10, 4 ft	10 / 13

For SI: 1 foot = 304.8 mm.

NR = No requirement.

- a. R-values are minimums. U-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 x 6 cavity.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
- d. R-5 shall be added to the required slab edge R-values for heated slabs.
- e. There are no SHGC requirements in the Marine zone.
- f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
- g. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2." [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-12 Ceiling insulation alternative.** Sections 402.1.1.1 through 402.1.1.8.1 are added to read as follows:  
**"402.1.1.1 Ceiling insulation alternative.** Insulation requirements for ceilings in buildings constructed in climate zone 1 shall meet one of the design options in Table 402.1.1.1.

**Table 402.1.1.1  
Ceiling Insulation for Buildings in Climate Zone 1**

Design Option	Design and Construction Components				
	Roof Insulation (Section 402.1.1.4)	Attic Ventilation (Section 402.1.1.5)	Radiant Barrier (Section 402.1.1.6)	Cool Roof (Section 402.1.1.7)	Roof Heat Gain Factor below 0.05 (Section 402.1.1.8)
1	R				
2 <sup>a</sup>		R	R		
3 <sup>a</sup>			R	R	
4 <sup>a</sup>					R

R = Required

a. Design Option is not allowed at building sites above a 2,400-foot elevation.

**402.1.1.2 Definitions.** For the purpose of this section, the following terms shall be defined as follows:

**GROSS AREA OF OPAQUE ROOF SURFACES.** Gross area of opaque roof surfaces means the total surface of the roof assembly exposed to outside air or unconditioned spaces. The opaque roof assembly shall exclude skylight surfaces, service openings, and overhangs.

**NET FREE VENT AREA.** Net free vent area means the total area through which air can pass in a screen, grille face or register.

**ROOF AREA.** Roof area means attic floor area; or, if there is no attic, "roof area" means the horizontal projection of roof area measured from the outside surface of the exterior walls.

**402.1.1.3 Construction documents.** Plans shall be submitted which indicate insulation type, thickness, and location; ventilation opening types, sizes and locations; radiant barrier location; and roof surface type as appropriate, depending on the option selected from Table 402.1.1.1.

**402.1.1.4 Roof insulation.** Roof insulation shall be provided as follows:

1. In buildings with an attic space provide either:
  - 1.1. R-30 insulation installed above the ceiling level, or
  - 1.2. R-19 insulation installed at the roof level between the roof framing members.
2. In buildings without an attic space provide either:
  - 2.1. R-19 insulation installed at the roof level between the roof framing members, or
  - 2.2. R-15 entirely above the roof deck.

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**402.1.1.5 Ventilation.** Ventilation shall be provided by at least one of the following:

1. A baffled ridge vent installed in accordance with the manufacturer's instructions in addition to lower inlet openings to provide a total of no less than one square foot of net free vent area for each 300 square feet of roof area. No less than 30 per cent of the total vent area shall be in either the ridge vent or the lower half of the ventilated space.
2. A solar-powered exhaust fan that provides at least one cubic foot per minute of airflow for each square foot of roof area.
3. Upper and lower vents with total net free vent area of at least one square foot for each 150 square feet of roof area. At least 30 percent of the total vent area shall be in the upper half of the ventilated space and at least 30 percent of the total vent area shall be in the lower half of the ventilated space.

**402.1.1.6 Radiant barrier.** A radiant barrier shall have an emissivity of no greater than 0.05 as tested in accordance with ASTM E-408. The radiant barrier shall be installed with the shiny side facing down and with a minimum air gap thickness of  $\frac{3}{4}$  inch below. The radiant barrier may be securely attached to the roof framing or may be laminated to the bottom of the roof sheathing.

**402.1.1.7 Cool roof.** A cool roof shall have an infrared emittance of no more than 0.75 when tested in accordance with ASTM E-408 and a high solar reflectance. The manufacturer's test results shall be acceptable for compliance.

**402.1.1.8 Roof Heat Gain Factor.** The Roof Heat Gain Factor (RHGF) shall not exceed 0.05 when calculated as described in Equation 402.1.1-1.

**Equation 402.1.1-1**

$$RHGF = U_r \times \alpha \times RB$$

Where:

$RHGF$  = Roof Heat Gain Factor [Btu/ft<sup>2</sup>-h-°F]

$U_r$  = overall thermal transmittance value for the gross area of opaque roof surfaces [Btu/ft<sup>2</sup>-h-°F]

$\alpha$  = roof surface absorptivity. Between 0.3 and 1.0 [unitless]

$RB$  = Radiant Barrier credit. Equals 0.33 if a radiant barrier is installed and 1.00 otherwise [unitless]. Radiant barrier installation must comply with Section 402.1.1.7.1 to qualify for Radiant Barrier credit.



**402.1.1.8.1 Radiant barrier credit.** To qualify for the radiant barrier credit (RB) described in Section 402.1.1.8, the installation of the radiant barrier must meet the following criteria:

1. The emissivity of the radiant barrier must be 0.10 or less. The manufacturer must provide test data or documentation of the emissivity as tested in accordance with ASTM E-408.
2. The radiant barrier must be securely installed in a permanent manner using one of the following installation methods:
  - 2.1. The radiant barrier shall be draped with the shiny side facing down over the top cord of the truss before the roof deck is installed. A minimum air gap of  $\frac{3}{4}$  inch must be provided between the radiant barrier and the roof deck above at the center of the span. A minimum  $\frac{3}{4}$  inch air gap must also be provided between the radiant barrier and the ceiling or insulation below.
  - 2.2. The radiant barrier shall be stretched with the shiny side facing down between the top cords of the truss and stapled or otherwise secured at each side. A minimum air space of  $\frac{3}{4}$  inch above and below is required.
  - 2.3. For attic installations only, the radiant barrier shall be stapled or otherwise secured to the bottom surface of the top cord of the truss and draped below with the shiny side facing down. A minimum air space of  $\frac{3}{4}$  inch above and below is required.
  - 2.4. For open beam ceiling construction only, the radiant barrier shall be laid on top of the roof deck with the shiny side facing up and a minimum  $\frac{3}{4}$  inch air gap between the radiant barrier and the roofing material above. The roof slope must be greater than or equal to  $14^\circ$  from horizontal.
3. At least one square foot of free area for ventilation shall be provided per 150 square feet of attic floor area, or in the case of vaulted or open-beam ceilings, per 150 square feet of ceiling area. In vaulted or open beam ceilings, the air space shall be vented with vent area approximately evenly distributed between the top and the bottom. In vaulted ceilings, vents shall be provided for each

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air space between rafters." [Eff **MAY 24 2010** ]  
 (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-13 Equivalent U-factors.** Table 402.1.3 is amended to read as follows:

**"Table 402.1.3  
 Equivalent U-Factors<sup>a</sup>**

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor	Floor U-Factor	Basement Wall U-Factor	Crawl Space Wall U-Factor
1	1.2	0.75	0.035	0.082	0.197	NR	NR	NR
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

NR = No requirement.

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source." [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-14 Glazed fenestration exemption.** Section 402.3.3 is amended to read as follows:

**"402.3.3 Glazed fenestration exemption.** Up to 15 square feet (1.4 m<sup>2</sup>) of glazed fenestration per dwelling unit shall be permitted to be exempt from U-factor and SHGC requirements in Section 402.1.1. North-facing windows and windows with a projection factor of 1.0 or more shall be permitted to be exempt from SHGC requirements in Section 402.1.1." [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-15 Unconditioned building exemption.** Section 402.4.1.1 is added to read as follows:

**"402.4.1.1 Unconditioned building exemption.** Unconditioned residential buildings are exempt from compliance with Section 402.4. The free-vent fenestration

area of unconditioned buildings shall be no less than 14 per cent of the floor area. All interior doors shall be capable of being secured in the open position and ceiling fan stub-ins shall be provided to living areas and bedrooms." [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-16 Fenestration air leakage.** Section 402.4.2 is amended to read as follows:

**"402.4.2 Fenestration air leakage.** Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m<sup>2</sup>), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m<sup>2</sup>), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

**Exceptions:**

1. Site-built windows, skylights and doors.
  2. Jalousie windows shall not exceed 1.2 cfm per square foot (6.1 L/s/m<sup>2</sup>)."
- [Eff **MAY 24 2010** ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-17 Residential pools.** Section 403.7 is added to read as follows:

**"403.7 Residential pools.** Residential pools shall be provided with energy conserving measures in accordance with Sections 403.7.1 through 403.7.3.

**403.7.1 Pool heaters.** All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

**403.7.2 Time switches.** Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

**Exceptions:**

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar- and waste-heat-recovery pool heating systems.

**403.7.3 Pool covers.** Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a

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pool cover with a minimum insulation value of R-12.

**Exception:** Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source." [Eff **MAY 24 2010** ]  
(Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-18 Mechanical systems commissioning and completion requirements.** Sections 503.2.9 through 503.2.9.3 are retitled and amended to read as follows:

**"503.2.9 Mechanical systems commissioning and completion requirements.** Prior to the issuance of a certificate of occupancy, the design professional shall provide a written statement of system completion in accordance with Sections 503.2.9.1 through 503.2.9.2.

**503.2.9.1 System commissioning.** Commissioning is a process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to specifications for further requirements. Copies of all documentation shall be given to the owner.

**503.2.9.2 Commissioning plan.** A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the original owner's project requirements;
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed;
3. Equipment and systems to be tested, including the extent of tests;
4. Functions to be tested (for example calibration, economizer control, etc.);
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.); and
6. Measurable criteria for acceptable performance.

**503.2.9.3 Systems adjusting and balancing.** All HVAC systems shall be balanced in accordance with generally

accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10 per cent of design rates. Test and balance activities shall include as a minimum the following items:

1. Air systems balancing: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

**Exception:** Fan with fan motors of 1 hp or less.

2. Hydronic systems balancing: Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

**Exceptions:**

1. Pumps with pump motors of 5 hp or less.
2. When throttling results in no greater than 5 per cent of the nameplate horsepower draw above that required if the impeller were trimmed." [Eff

MAY 24 2010 ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

**§3-181-19 Referenced standards.** The following standard is added to chapter 6 - Referenced Standards to read as follows:

"ASTM E 408-2008, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection Meter Techniques.....402.1.1.6, 402.1.1.7, 402.1.1.8.1 [Eff MAY 24 2010 ] (Auth: HRS §107-29) (Imp: HRS §§107-24, 107-25)

DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

Chapter 3-181, Hawaii Administrative Rules, on the Summary Page dated October 13, 2009 was adopted on October 13, 2009, following a public hearing held on Oahu, Maui, Hawaii, and Kauai on September 30, 2009, after public notice was given in the Honolulu Star Bulletin, The Maui News, Hawaii Tribune Herald, West Hawaii Today, and The Garden Island on August 31, 2009.

The adoption of chapter 3-181 shall take effect ten days after filing with Office of the Lieutenant Governor.



RUSS K. SAITO, State Comptroller  
Department of Accounting and  
General Services and  
Chairperson, State Building  
Code Council

APPROVED:



LINDA LINGLE, Governor  
State of Hawaii

Dated: 5/13/10

APPROVED AS TO FORM:



Deputy Attorney General

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Filed